FIG. 1

Native (LLC)
Packets From
Different LLCs
Associated With One ATM
Connection

LLC Packets Prefixed By Packet Headers.
CID Corresponding To LLC;
LI Representing Packet Length
Pointing To End Of Packet;

Cells From
One ATM Connection

LLC=3

LLC=1

LLC=2

LLC=3

LLC=1

LLC=2

LLC=3

LLC=1

61

Packet
Header
(CID=1)

60   62

Packet
Header
(CID=3)

Packet
Header
(CID=2)

ATM
Header

1

STF

2   3

50

51

Pointer in STF
Points To

ATM
Header

STF

52

Pointer in STF
Points To

CID 8 bits	LI 6 bits	RES 5 bits	HEC 5 bits

Packet Header (3 octets)

FIG. 2

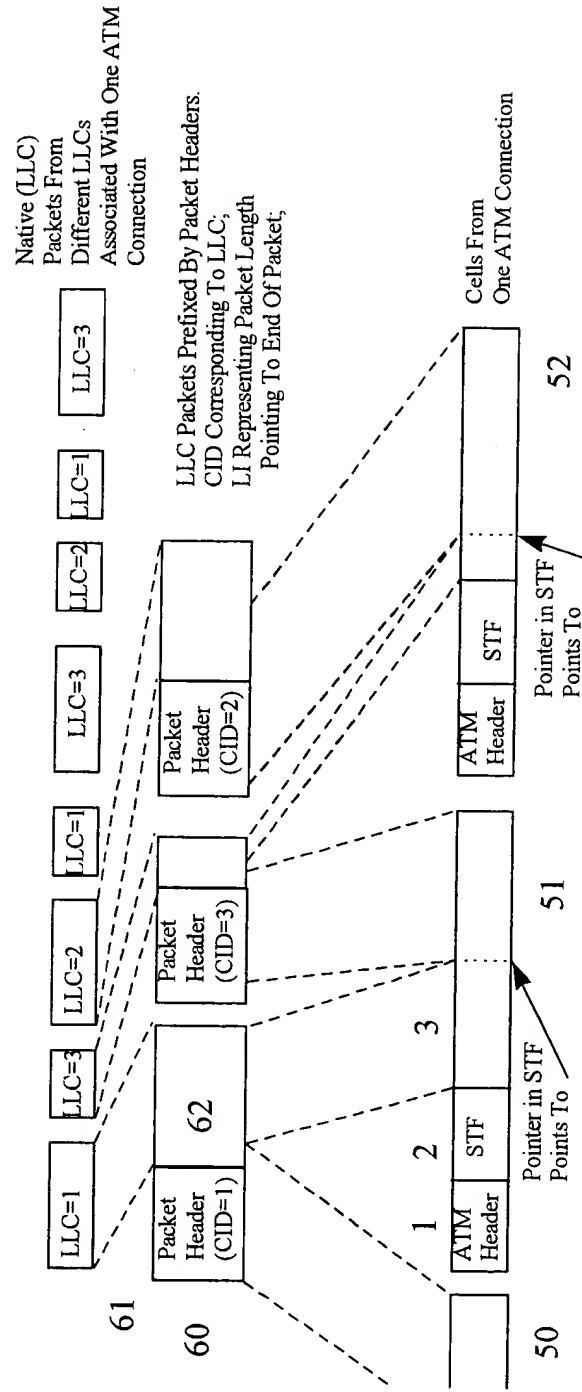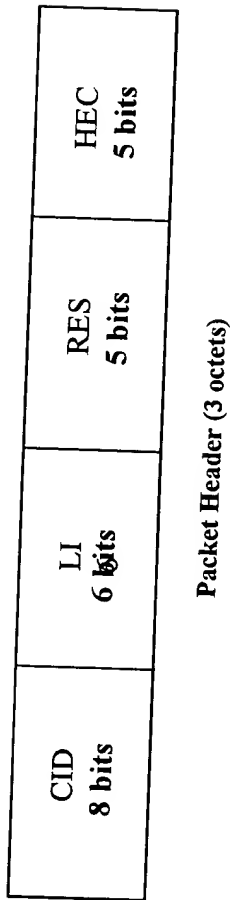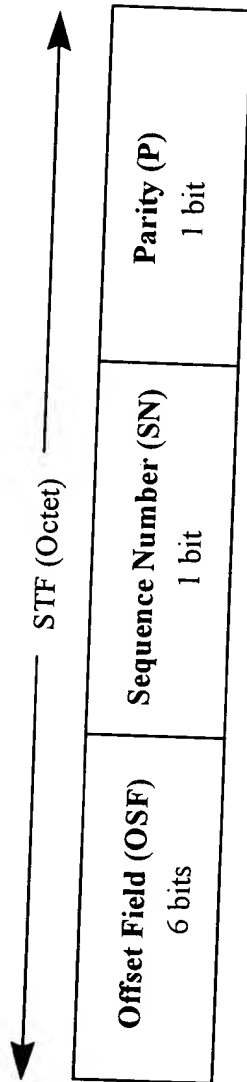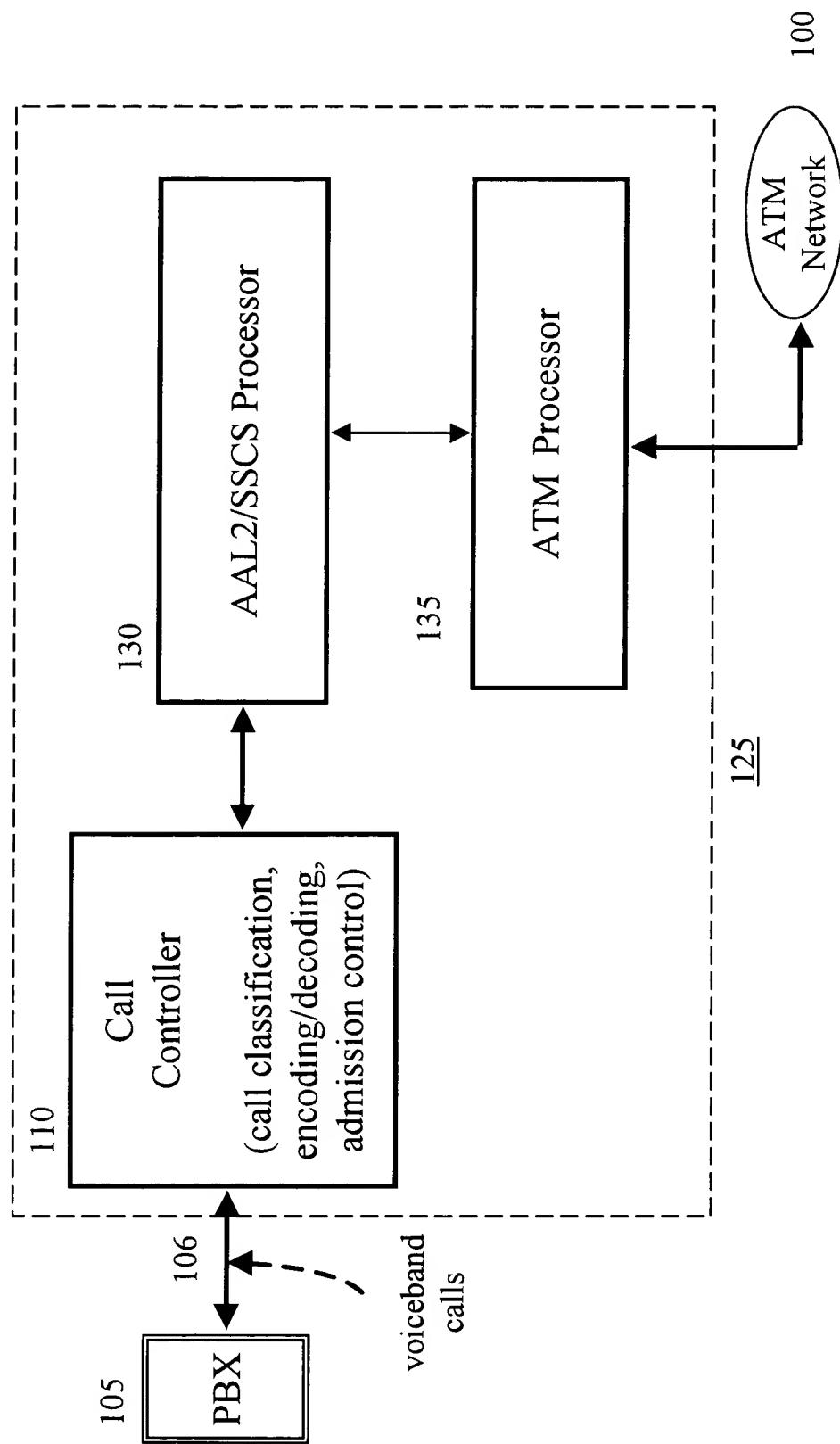| Offset Field (OSF) 6 bits	Sequence Number (SN) 1 bit	Parity (P) 1 bit

STF (Octet)

FIG. 3

FIG. 4

FIG. 5

TRAFFIC TYPES AND BANDWIDTH

Call Type Identifier	Traffic Types	Bandwidth	Bandwidth including AAL2 overhead	Bandwidth including AAL2 and ATM overhead
0	G.727 Voice with silence elimination	32 kb/s (peak)	36.8 kb/s (peak) 14.7 kb/s (average)	41.5 kb/s (peak) 16.6 kb/s (average)
1	14.4 28.8 kb/s modem	40 kb/s (?)	44.8 kb/s	50.5 kb/s
2	28.8 kb/s to 56 kb/s modem	64 kb/s	68.8 kb/s	77.6 kb/s
3	G3 Facsimile	9.6 kb/s	14.4 kb/s	16.2 kb/s

· Assuming 5 ms AAL2/SSCS packetization interval in all cases.

· Voice activity = 40 % (average talkspurt = 400 ms, and average silence = 600 ms).

FIG. 6

BLOCK (or BIT) DROPPING FOR CONGESTION CONTROL

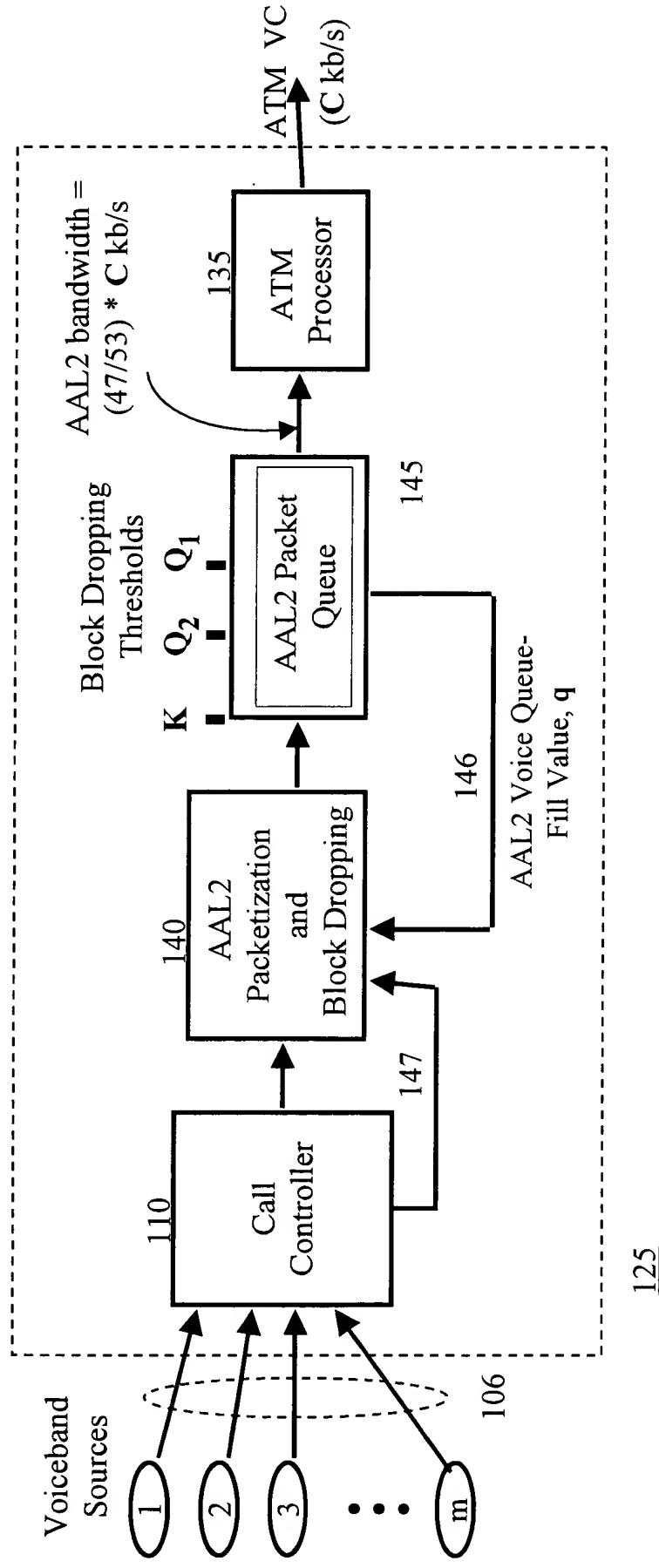INPUT BLOCK DROPPING: Block-Dropping at Input of AAL2 Queue

FIG. 7

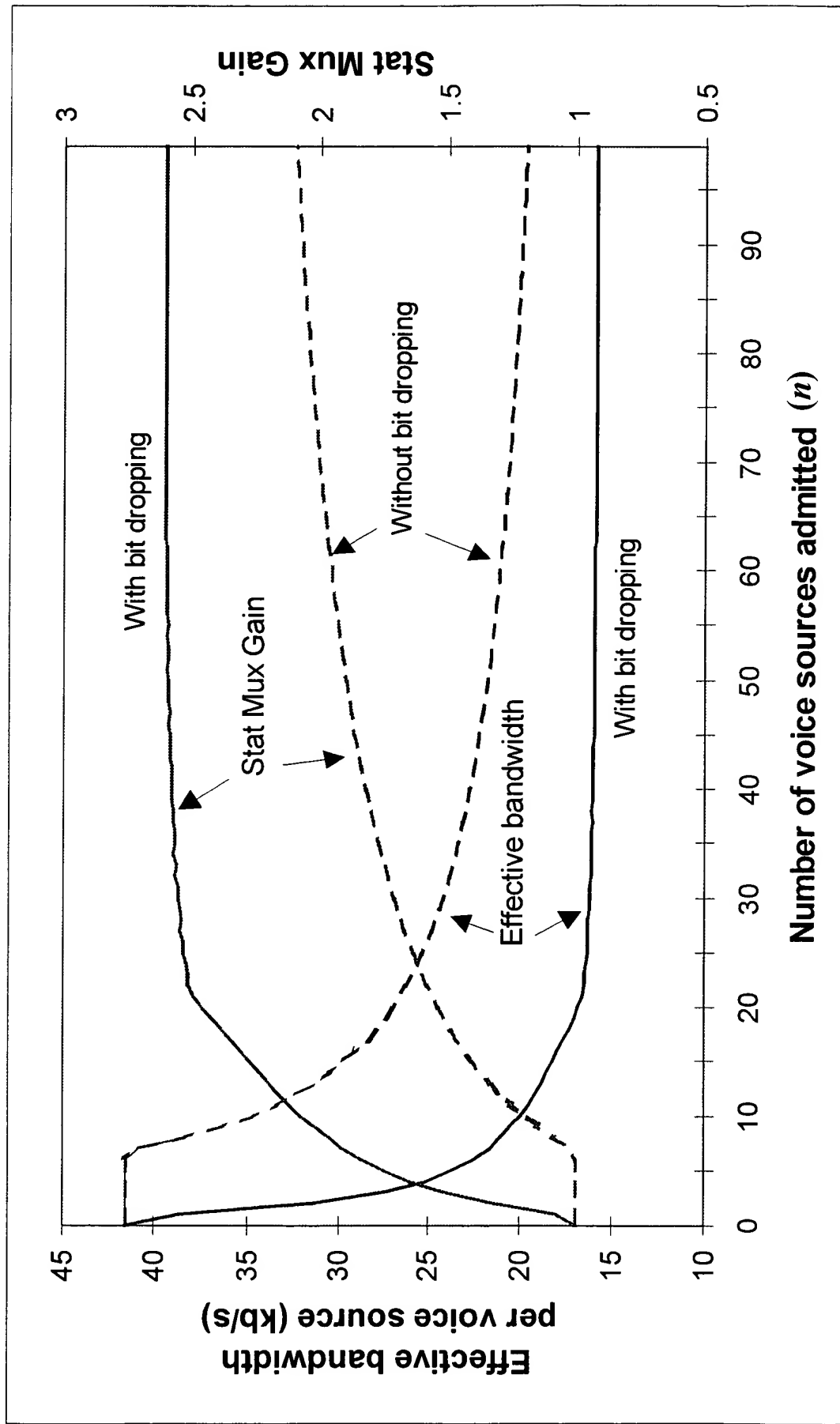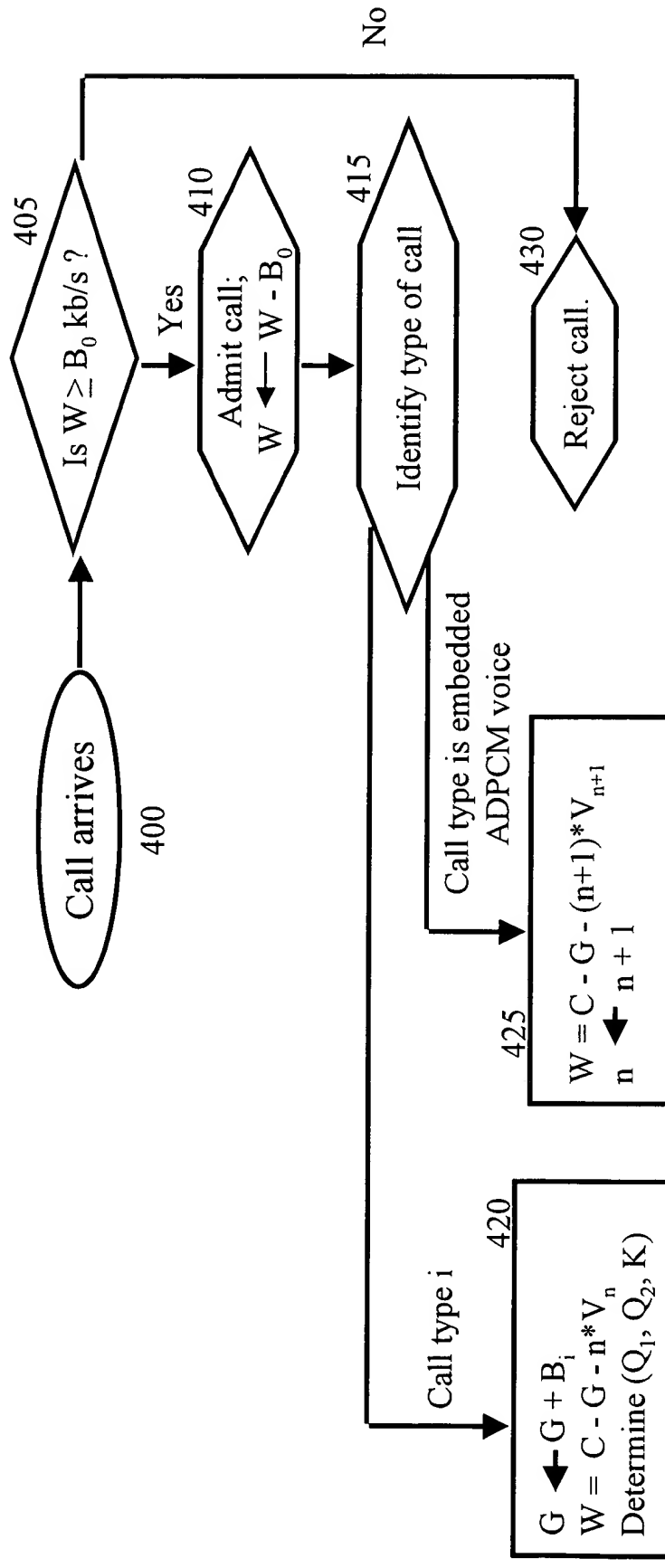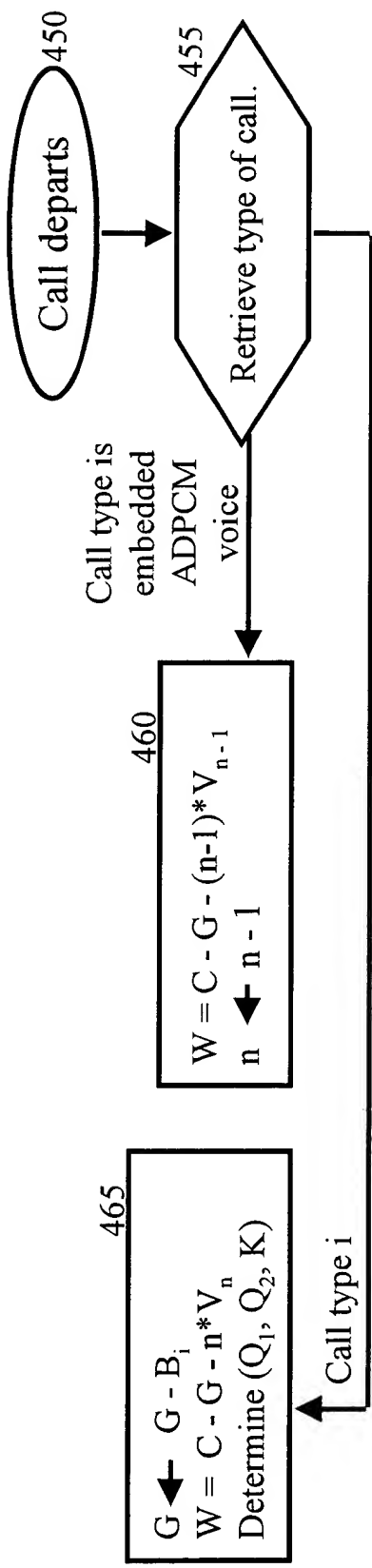EFFECTIVE BANDWIDTH (V_n) AND STATISTICAL MULTIPLEXING GAIN

Sriram-Wang 15-9

FIG. 8

```
        ( Call arrives )
             400
               │
               ▼
         ╱─────────╲
        ╱    405    ╲
       ╱  Is W ≥ B₀   ╲ ──No──┐
       ╲   kb/s ?     ╱       │
        ╲           ╱         │
         ╲─────────╱          │
             │                │
            Yes               │
             ▼                │
         ┌─────────┐          │
         │   410   │          │
         │ Admit   │          │
         │ call;   │          │
         │ W ← W-B₀│          │
         └─────────┘          │
             │                │
             ▼                │
        ╱──────────╲          │
       ╱    415     ╲         │
      ╱  Identify     ╲       │
      ╲  type of call ╱       │
       ╲            ╱         │
        ╲──────────╱          │
         │        │           │
         │        │           ▼
Call type i   Call type is   ┌─────────╲
         │    embedded       │   430    │
         │    ADPCM voice    │ Reject   │
         ▼         │         │ call.    │
   ┌──────────┐    ▼         ╲─────────┘
   │   420    │  ┌─────────┐
   │ G ← G+Bᵢ │  │   425   │
   │ W = C-G  │  │ W = C-G-│
   │  -n*Vₙ   │  │ (n+1)*  │
   │ Determine│  │  Vₙ₊₁   │
   │(Q₁,Q₂,K) │  │ n ← n+1 │
   └──────────┘  └─────────┘
```

Node 405: Is $W \geq B_0$ kb/s ?

Node 410: Admit call; $W \leftarrow W - B_0$

Node 415: Identify type of call

Node 430: Reject call.

Node 420 (Call type i): $G \leftarrow G + B_i$; $W = C - G - n*V_n$; Determine (Q_1, Q_2, K)

Node 425 (Call type is embedded ADPCM voice): $W = C - G - (n+1)*V_{n+1}$; $n \leftarrow n + 1$

Sriram-Wang 15-9

FIG. 9

Call departs   450

Retrieve type of call.   455

Call type is embedded ADPCM voice

460

$W = C - G - (n-1)*V_{n-1}$
$n \rightarrow n - 1$

465

$G \rightarrow G - B_i$
$W = C - G - n*V_n$
Determine (Q_1, Q_2, K)

Call type i

FIG. 10

ORGANIZATION OF VOICE PACKET

5 ms packetization interval (40 ADPCM samples * 4 bits per sample =160 bits = 20 bytes)

Block # 0

Least Significant Bits

Block # 1

Block # 2

Block # 3

Most Significant Bits
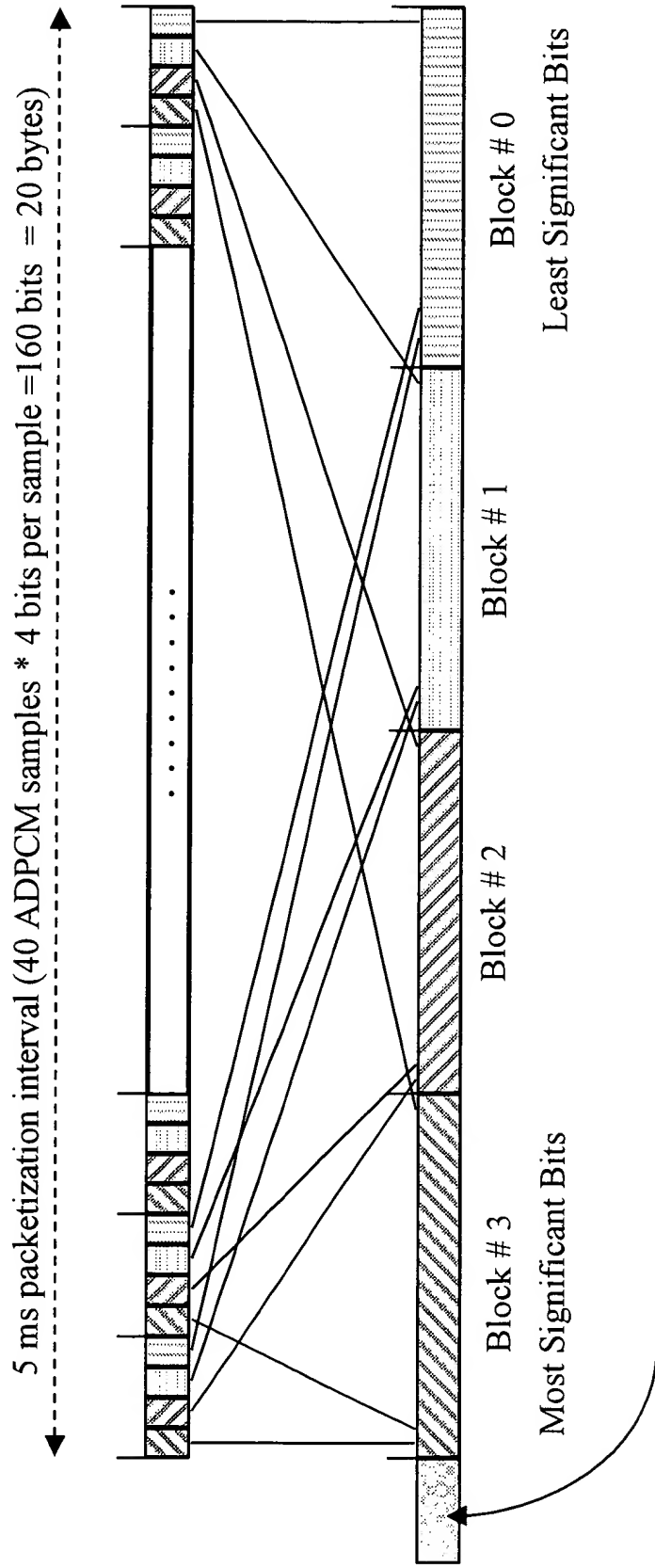
FIG. 11

Congestion State Table

Congestion State	Blocks Dropped from AAL2 Packet	Packet Size
Low ($0 \leq q \leq Q_1$)	None	23 bytes
Moderate ($Q_1 \leq q \leq Q_2$)	Block 0	18 bytes
High ($Q_2 \leq q \leq K-1$)	Blocks 0 and 1	13 bytes
Buffer Overflow ($q \geq K$)	Whole packet dropped	--

FIG. 12

C_v = bandwidth currently available for block-droppable voice **300**

310 Is $C_v \leq 333$ kb/s ?

Yes → **330** $Q_1 = 10$, $Q_2 = 20$, $K = 30$

No →

320 Is $C_v > 1000$ kb/s ?

No → **340** $Q_1 = \left\lceil \dfrac{30 * C_v}{1000} \right\rceil$; $Q_2 = \left\lceil \dfrac{60 * C_v}{1000} \right\rceil$; $K = \left\lceil \dfrac{90 * C_v}{1000} \right\rceil$

Yes → **350** $Q_1 = 30$, $Q_2 = 60$, $K = 90$
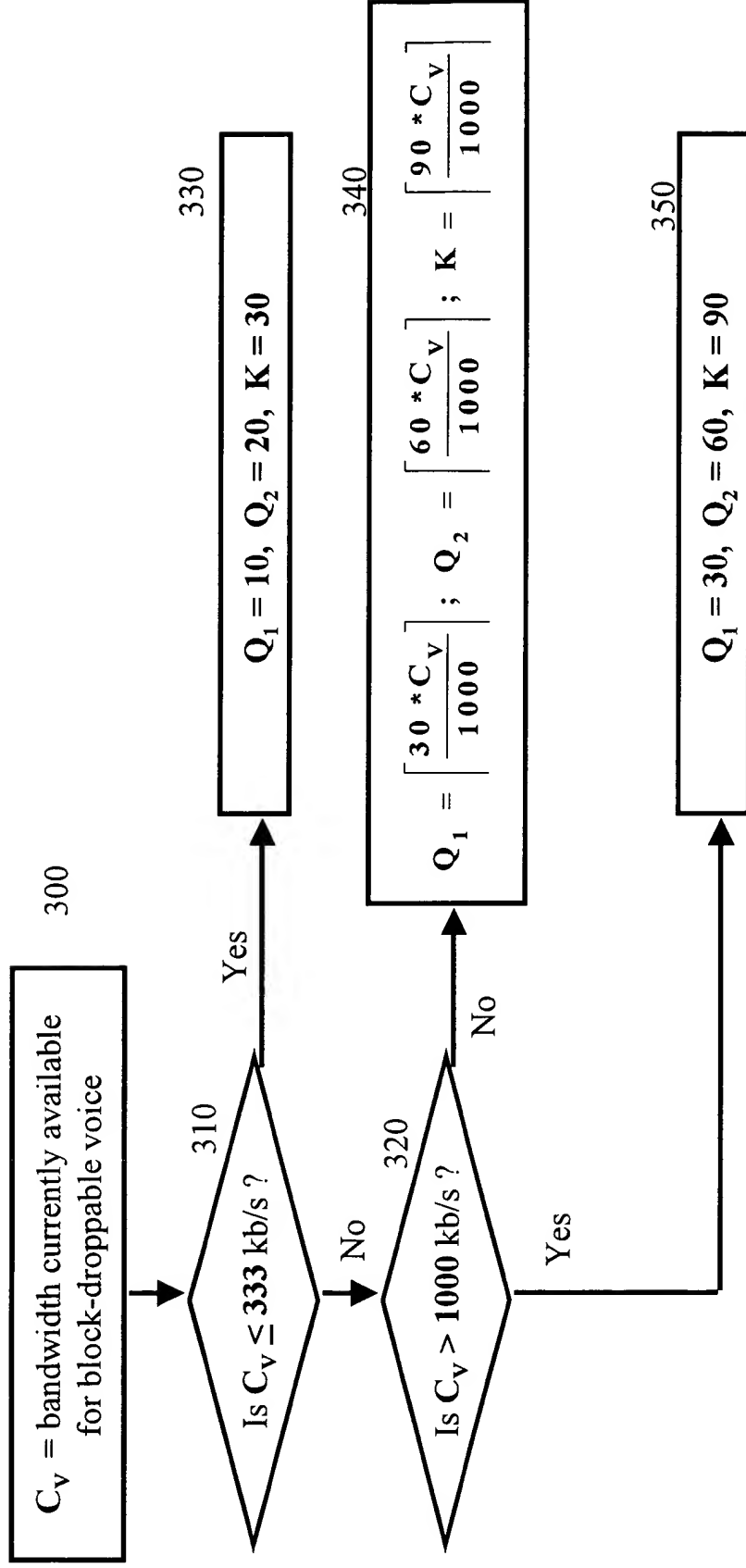
FIG. 13

BLOCK (or BIT) DROPPING FOR CONGESTION CONTROL

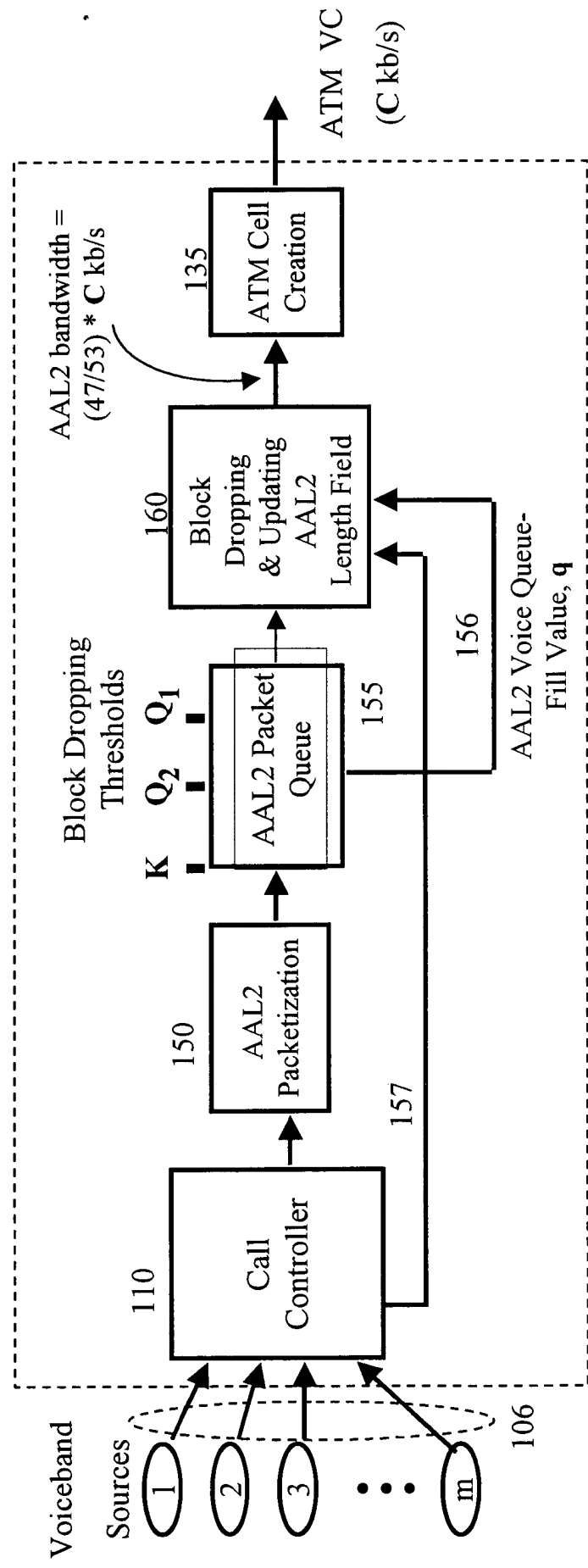OUTPUT BLOCK DROPPING: Block-Dropping at Output of AAL2 Queue

FIG. 14

BLOCK (or BIT) DROPPING FOR CONGESTION CONTROL

INPUT BLOCK DROPPING: Block-Dropping at Input of ATM Processor